Use of recombinant human erythropoietin to avoid blood transfusion in a Jehovah's Witness requiring hemispherectomy

Case report

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The use of perioperative human recombinant erythropoietin is described in a Jehovah's Witness patient. Despite significant anemia, the child's hematocrit was sufficiently increased by the use of erythropoietin so that a two-stage hemispherectomy could be performed without blood transfusion.

KEY WORDS • erythropoietin • Jehovah's Witness • hemispherectomy • hematocrit

ERYTHROPOIETIN is an endogenous human hormone that is produced in the kidneys and stimulates bone marrow production of red blood cells. It is now available in recombinant form, produced in tissue culture from Chinese hamster ovarian cells into which the human gene for this protein has been inserted. It has been well studied in patients with chronic renal failure.

In preoperative orthopedic patients, erythropoietin significantly increased the collection of autologous blood prior to elective surgery. A recent report, published in Japanese, describes using recombinant erythropoietin to maintain hematocrit in preoperative patients with autologous preoperative blood preservation prior to cardiac surgery. Isolated reports have appeared describing its use in Jehovah's Witness patients who were anemic following thermal injury, gastrointestinal bleeding, major trauma, and major surgery. Recently, eight Jehovah's Witness patients were reported who had received preoperative erythropoietin in an effort to raise their hemoglobin concentrations prior to major cardiovascular or orthopedic procedures where blood loss would ordinarily require transfusion. We are aware of no previous reports of preoperative human recombinant erythropoietin being used to avoid transfusion in a neurosurgical procedure.

Case Report

This 15-year-old black female Jehovah's Witness had intractable epilepsy. She first suffered seizures at 2½ years of age, and her disorder was poorly controlled with different medical regimens throughout her life. She had complex partial seizures, usually followed by a transient postictal left hemiparesis. Her condition progressed to a permanent left hemiparesis without visual field deficit which gradually developed over the 3-year period prior to her present admission. Her left hand had lost all fine motor skills, but she was still able to walk using a leg brace, maintaining minimal distal lower-extremity voluntary function.

Admission. The patient was admitted to the hospital with refractory epilepsy partialis continua and frequent prolonged secondary generalization that continued despite 4 weeks of pentobarbital coma. A preoperative computerized tomography (CT) brain scan revealed mild diffuse right hemisphere atrophy.

Operations. The family consented to permit hemispherectomy but refused blood transfusion. Human recombinant erythropoietin was begun at a dose of 11,000 U subcutaneously every other day. The hemoglobin concentration and hematocrit rose from 9.5 gm/dl and 29.8% to 12.0 gm/dl and 37.3% over a period of 14 days. She was taken to the operating room where a functional hemispherectomy was begun. The operation was terminated when the estimated blood loss of 400 cc appeared to place the patient at risk for transfusion in the postoperative period. Pathological examination of the removed cerebral tissue confirmed our clinical diagnosis of Rasmussen's syndrome.

The patient continued to receive erythropoietin for
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FIG. 1. Computerized tomography scan obtained after the second operation showing completion of an anatomically partial but functionally complete hemispherectomy.

6 additional days. Her immediate postoperative hemoglobin concentration and hematocrit were 8.9 gm/dl and 27%, dropping to 7.8 gm/dl and 24.7% by Day 4 after surgery and returning to 8.6 gm/dl and 27% by Day 6, when she was again taken to the operating room for completion of the functional hemispherectomy. The estimated blood loss from this second procedure was 225 cc. Her immediate postoperative hemoglobin concentration and hematocrit were 7.6 gm/dl and 23.7%, dropping to 6.5 gm/dl and 21.1% 3 days after the second operation. A postoperative CT scan is shown in Fig. 1, demonstrating completion of the disconnection of the hemisphere, in the manner of Rasmussen.6

Postoperative Course

The patient continued to receive erythropoietin for an additional 29 days and ferrous sulfate (40 mg of elemental iron) was added three times per day. She was weaned from the pentobarbital and placed on a course of carbamazepine, phenobarbital, and phenytoin. She was discharged home from the hospital 34 days postoperatively with a hemoglobin concentration of 9.1 gm/dl and a hematocrit of 28.8%. She has had no clinical seizures in 14 months of follow-up monitoring.

Discussion

Consistent with the reports cited above, preoperative administration of erythropoietin can increase a patient’s basal hemoglobin concentration and hematocrit to levels that permit extensive surgical procedures without blood product administration. In this case, a staged surgical procedure was used. Erythropoietin was administered throughout the perioperative period of both procedures, and appeared instrumental in maintaining safe hemoglobin levels without blood transfusion.

Questions have been raised regarding the use of small amounts of albumin as a diluent in the injectable erythropoietin preparation.4 This issue is well discussed by Law, et al.;11 in practice, the presence of this nonrecombinant protein, similar to the presence of proteins in vaccines, has not met resistance from patients and their families in the cases cited above.

Patients receiving erythropoietin will have a decrease in their iron stores and require elemental iron replacement.4,11 Complications of erythropoietin use in patients with renal failure have included hypertension, hyperviscosity leading to thrombosis, and hypertensive encephalopathy with seizures.10,17 There are two reports of nonhypertensive hemodialysis patients who suffered seizures while receiving erythropoietin.6 One hemodialysis patient on a long-term course of erythropoietin has developed a cerebral infarct.2 Although the reported cases are few, no patient who was otherwise normal preoperatively has experienced complications from the use of this hormone. Nevertheless, more widespread perioperative use may uncover serious side effects. In a recent randomized controlled trial, one case of peripheral artery thrombosis may have been attributable to postoperative erythropoietin use.5 Although this hormone is expensive, the cost is offset by the savings in hospital charges for transfusion of heterologous or autologous blood.17

Clearly the use of recombinant erythropoietin may have a role in enabling patients to avoid blood transfusion during elective surgical procedures. This use would be predicated upon demonstrating that the risks of a 2- to 3-week course of erythropoietin would be lower than the risks of a 2-unit blood transfusion. As knowledge of blood-borne pathogens increases our concern regarding the risks of transfusion in all patients, the prospect of more widespread use of erythropoietin as a preoperative adjunct becomes more attractive.

Acknowledgment

We are indebted to the thoracic surgeon, Dr. J. Sell, for suggesting the possible use of erythropoietin in this patient.

References


Manuscript received October 30, 1992. Accepted in final form April 1, 1993.
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